

Semi-annual Report January 1st -- June 30th, 1974

NASA-PY PROJECT

The Application of Space Technology to Practical Problems
Such as Those Currently Facing the
Mountain Sections of the State of Colorado

Jack D. Ives

June 1974

NASA-PY Project
Grant No. NGL-06-003-200

The NASA Technical Officer for this grant is

Joseph E. Vitale
NASA Office of University Affairs
Washington, D.C.

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PRICES SUBJECT TO CHANGE

(NASA-CR-138500) THE APPLICATION OF
SPACE TECHNOLOGY TO PRACTICAL PROBLEMS
SUCH AS THOSE CURRENTLY FACING THE
MOUNTAIN SECTIONS OF THE STATE OF
(Colorado Univ.) 7 p

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Delimitation of Natural Hazards
in Sections of Montane Colorado

1. Objectives

Rapid growth of small mountain communities as a response to the demand for recreational needs is a special phenomenon of montane Colorado. In areas of rugged terrain, such growth is tightly constrained in terms of available flat or gently sloping land. This has resulted in a great surge in land speculation and building development in areas that are potentially dangerous to life and property due to a variety of natural processes: snow avalanche, mudflow, rockfall, landslide and flood, as well as the slow but continuous and frequently imperceptible forms of soil creep and associated mass movement. For the current reporting period, emphasis has been placed upon further refinement and development of field and laboratory methods for identification and rapid mapping of large scale, infrequent natural occurrences, especially snow avalanches. Specific objectives include:

- a) assessment of relative reliability of ERTS and Skylab imagery and conventional air photography in identification of avalanche paths and run-out zones;
- b) completion of particular natural hazard maps and reports for mountain communities: Telluride, Crested Butte and Vail, Colorado;
- c) consultation with Vail Associates Incorporated to derive a detailed approach to precise mapping of 137 acres of land near Vail with a view to designation of adequate building design and avalanche protection structures.

- d) synthesis of all accumulated data and expertise in preparation for production of a major monograph;
- e) refinement of dendrochronological techniques for determination of frequency of avalanche occurrence;
- f) continued liason at township, county, state and federal agency levels to ensure that practical use is made of the research results;
- g) application of project findings to the Unesco Man and the Biosphere Project 6 research planning effort.

2. Personnel January 1st to June 30th, 1974

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|----------------------|--|
| a) Jack D. Ives | Principal Investigator |
| b) Richard F. Madole | Research Geologist III
(separated April 30th, 1974) |
| c) Paula V. Krebs | Research Ecologist II |
| d) Arthur Mears | Engineering Geologist |
| e) Paul Carrara | Geologist |
| f) David Groenveld | Graduate student -- ecology |
| g) Michael Glen | Graduate student -- ecology |

In addition assistance in various forms was provided by INSTAAR faculty professors Andrews, Barry, Caine, Nichols and Webber, by Dr. Floyd Mann, Director, CU Environmental Council and by numerous township, county, state and federal agency officials.

3. Internal Reports Completed

- a) "Evaluation of the snow avalanche hazard in the valley of Gore Creek, Eagle County, Colorado." January, 1974, 34 pp. mimeo.

- b) "Tree-ring dating of snow avalanches" by D. Michael Glenn (also presented as a paper to the Colorado-Wyoming Academy of Sciences).
- c) "Forest cover-type mapping using color infrared aerial photography" by David P. Groenveld and Paula V. Krebs (also presented as a paper to the Colorado-Wyoming Academy of Sciences).
- d) "Air photo recognition of common natural hazards in mountainous Colorado using NASA-PY imagery" by Paul Carrara.
- e) "An evaluation of the feasibility of identifying snow avalanche tracks from ERTS imagery" by Paul Carrara.
- f) "The cost of building in avalanche run-out areas: some alternatives compared" by Arthur Mears.
- g) "Analysis of flood and debris flow hazard on Cornet Creek, Telluride, Colorado" by Arthur Mears and Paul Carrara.
- h) "A method for determining the sizes of large avalanches" by Arthur Mears.
- i) "A hazard map of the Crested Butte area, Colorado" by Arthur Mears and Paul Carrara.
- j) Paper resulting from work completed during 1973: "Land type analysis for regional land use planning from photomorphic mapping: an example for Boulder County, Colorado" by Janet E. Nichol (also presented to the Ninth Annual Symposium on Remote Sensing, Ann Arbor, Michigan).

4. Site visit by Dr. Frank Hansing and Mr. J. Vitale

During the period May 8th to 10th inclusive, Messrs. Frank Hansing and Joseph Vitale visited INSTAAR in Boulder and later spent a day in Vail.

This afforded the opportunity for formal and informal presentations and meetings with representatives of the various agencies with which the staff of the project are working. It also helped INSTAAR greatly in appraising the results of the project to date.

5. Man and the Biosphere (MAB) Project 6
Impact of human activities on mountain and tundra ecosystems

Since Jack D. Ives was elected chairman of the International Working Group for Project 6 there has been an opportunity to relate INSTAAR's growing expertise in remote sensing applications to the initial planning phases of this major international research undertaking. This should be particularly important for the MAB Project 6 regional meeting being held in La Paz, Bolivia June 10-15, 1974. In preparation for this meeting, ERTS and Skylab imagery of the Bolivian Andes and Colorado Rocky Mountains was prepared and an evaluation of application potential undertaken in La Paz. The details of this evaluation will be reported separately.

Another MAB Project 6 development relates to the national United States level. Ives has been awarded a planning grant by the National Science Foundation for organization of a workshop in Boulder, Colorado, July 22-26. The objective will be to prepare a document to form the basis for national research within the context of the United States' commitment to the Unesco MAB program. In particular, remote sensing applications will be reviewed. To this end, Dr. Robert Colwell, Associate Director of Space Science, Berkeley, California and Dr. Roger Hoffer of LARS, Purdue, have been invited and requested to prepare position papers for inclusion in the final report, due November 15th, 1974.

6. Objectives for the next six month period

- a) Preparation of a major monograph on remote sensing applications to natural hazard delimitations in the Colorado mountains.
- b) Preparation of a report/Masters thesis to document the Vail long-term plan and its dependence on INSTAAR's natural hazard mapping.
- c) Development of avalanche mapping criteria such that legal suits taken against Vail and other townships can be defended in court.
- d) Production of hazard maps for San Miguel County and Telluride Township using various levels of imagery with field support.
- e) Incorporation of six new graduate students with the project.

Jack Ives
J. D. Ives
June 1974

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UNIVERSITY OF COLORADO
INSTITUTE OF ARCTIC AND ALPINE RESEARCH
BOULDER, COLORADO 80302

June 4, 1974

Mr. Joe Vitale
Room 6125
400 Maryland Ave. SW
NASA Office of University Affairs
Washington, D.C. 20546

Dear Joe:


I have enclosed a rather brief semiannual report relating to our NASA-PY Grant #NGL-06-003-200. I hope you will concur with my slight change in the reporting period, ie. January 1 to June 30. If this is satisfactory with you, it will appreciably simplify our regular reporting input with the 2 half-yearly reports following close after the end of the spring and fall semesters respectively. This one is decidedly brief because of my imminent departure for 3 weeks in Bolivia, but we should have some useful special reports through the next 3 or 4 months.

I am delighted to report that Bob Colwell will apparently be an enthusiastic participant in our Man and the Biosphere workshop. Many thanks for your help on this matter.

It also appears that San Miguel County (Telluride - Mark Frauhiger) and San Juan County will soon be making formal requests for our participation in natural hazard delimitation. Art Mears and Paul Carrara will be in Vail next week for most of the summer. I hope we will thereby manage to produce avalanche run-out specifications that will stand up in court. In addition, I have attracted a graduate student to take over the extensive documentation in Terry Minger's office in Vail as a Master's dissertation topic. This hopefully will result in a good verification of the physical impact of our hazard mapping on the future city of Vail.

Many thanks for your good wishes to our crew. We have very much enjoyed your incisive presence.

Yours sincerely,


Jack D. Ives
Director

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